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Historical Insights

Operation Grapple:
It looks as though we've got what we wanted

Sixty years ago, at 0843 local time, on 8 November 1957, Royal Air Force Valiant XD824 dropped a bomb off Christmas Island in the Pacific containing an experimental thermonuclear device.

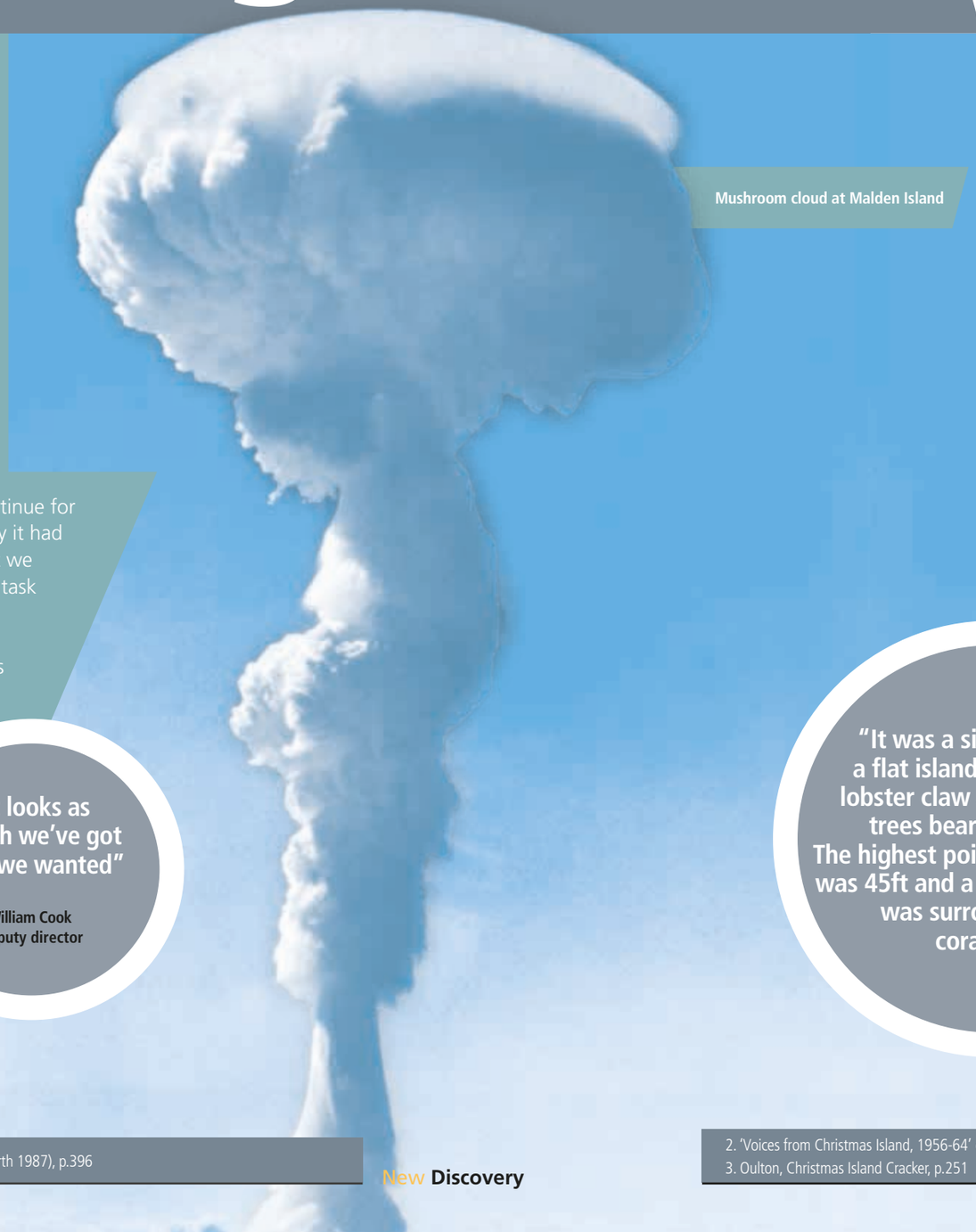
As the Valiant turned away in its standard escape manoeuvre to avoid the blast, around 3000 services and 100 civilian AWRE personnel on and around the island – facing, as instructed, away from the explosion – saw an intense flash of light through hands and goggles, felt a flush of heat on their backs and, when permitted to turn round, watched the rolling fireball and mushroom cloud rise into the morning sky.

Analysis of data from the Grapple-X test would continue for many months, but the AWRE party knew right away it had been a success. "It looks as though we've got what we wanted", AWRE deputy director William Cook told task force commander Air Vice Marshal Wilfrid Oulton.[1]

Successive thermonuclear tests in the Grapple series between May 1957 and September 1958 were conducted under intense domestic and international political pressure. Military and civilian personnel worked day and night with a palpable sense of time running out – and a last-minute drama at sea nearly derailed Grapple-X. This short account outlines the tasks carried out by AWRE during the Grapple tests and introduces life on Christmas Island, the pressures faced and the results achieved.

"It looks as though we've got what we wanted"

William Cook
Deputy director



Mushroom cloud at Malden Island

Serious logistic planning for testing British thermonuclear weapons – 'H-bombs' – in the Pacific began in September 1955 with a photo reconnaissance by the RAF. Christmas Island, sighted on 25 December 1777 by Captain Cook, is a large coral atoll in the remote Pacific, over 1000 miles south of Hawaii. Then part of the Gilbert and Ellice Islands colony, its few attractions included an abandoned wartime US staging base with airfield, a sheltered harbour, a transient population of Gilbertese copra harvesters and very little fresh water. One veteran recalled: "It was a sight to behold, a flat island, shaped like a lobster claw and full of palm trees bearing coconuts. The highest point above sea level was 45ft and a salt water lagoon was surrounded by a coral reef. The water was clear as gin."[2]

The site for the first test explosion would actually be off Malden Island, 400 miles further south of Christmas Island and uninhabited.

The very remoteness of these islands was their key advantage as a nuclear test range, but it meant an elaborate military operation to create, in Oulton's words, "all the essential infrastructure of a small town, a V-bomber base and a high-class scientific establishment."[3] The spring 1957 deadline was based on the military requirement for a megaton deterrent weapon and the political requirement to beat the deadline of a nuclear test ban, first discussed in 1954. In nuclear policy, prime minister Harold Macmillan was for eating his cake and having it: developing the H-bomb, and also banning tests. Thus, in May 1957, testing began at Malden Island just as the UK tabled specific proposals through the UN in Geneva on the operation of a ban.

The Royal Navy provided heavy lift, guard ships and, for the first Grapple tests, the HQ ship HMS Warrior and instrumentation ship HMS Narvik. The small naval facility on Christmas Island was known as 'Naval Party 2512' after the date of Captain Cook's discovery, until it was renamed HMS Resolution in December 1957 after his ship. The Royal New Zealand Navy also contributed ships.

"It was a sight to behold, a flat island, shaped like a lobster claw and full of palm trees bearing coconuts. The highest point above sea level was 45ft and a salt water lagoon was surrounded by a coral reef"

The Royal Engineers did back-breaking work to bring the airfield up to standard for Valiants and other heavy aircraft, also creating laboratories, (mostly tented) living accommodation, fuel storage, water distillation plant, communications, Church of England and Roman Catholic churches and a field post office, where coconuts could later be posted provided the address was clearly painted on and stamps affixed to the sum of around four shillings and six pence, depending on weight.

1. AVM Wilfrid Oulton, Christmas Island Cracker (Harmsworth 1987), p.396

2. 'Voices from Christmas Island, 1956-64' ed. David Whithorn, 2014 (AWE archive document)
3. Oulton, Christmas Island Cracker, p.251

HMS Warrior off Malden Island

As well as Valiants to drop the bombs, the RAF provided transport, reconnaissance, air and cloud sampling, and search and rescue aircraft and helicopters. The last of these boasted, in the unofficial newsletter Mid Pacific News, that "our other task on the island is ferrying everything from boffins to bananas anywhere at any time."[4]

These boffins, from AWRE, were divided into three groups for weapon assembly, test measurement and technical services. Weapon assembly meant bringing together complex radioactive, high explosive and electronic components safely and loading onto aircraft without in any way compromising the standards expected at bigger, permanent facilities in the UK. Test measurement covered air and ground shock and radio, heat and gamma-ray flash effects, photographic measurement of the fireball, radiochemical analysis and monitoring the condition of the test devices throughout. Technical services included health physics and decontamination for all military and civilian personnel.

Life on Christmas Island was basic, with camp beds, set just high enough to avoid the ubiquitous local coconut crabs. And showers and DIY laundry where lathering soap – in salt water – was quite a chore. AWRE civilians in particular complained about the food. Potatoes were especially hard to keep fresh in the humidity of Christmas Island, and several barrels of Watney's Pale Ale had to be condemned and buried. Recreations included fishing, swimming in the lagoon, cricket and a golf net, and the scientific party was generally a happy one. William Cook's deputy for the first Grapple tests, and head of the weapon assembly group, was Charles Adams; Ken Bomford led the measurement group; and John Challens headed technical services. Bomford later took over as scientific superintendent, overseeing all three groups under Cook.

"These boffins, from AWRE, were divided into three groups for weapon assembly, test measurement and technical services"

Cook, in particular, remained unflappable, never without his trademark pipe, despite seriously sunburning his legs on first arrival and then falling victim to food poisoning. At home at Aldermaston, Cook maintained a strong personal grip on the whole thermonuclear programme, the parallel low-yield tests underway in 1957 in Australia and the production of service weapons for the RAF. His boss, AWRE director, Sir William Penney, meanwhile faced the sombre task of preparing a personal report for Macmillan on the Windscale fire of October 1957, and for two months in summer 1958 played a key part in the disarmament talks in Geneva. Both men were also called upon for important meetings with their US counterparts; 1957-58 were the years in which the Anglo-American atomic relationship was rebuilt.

The first and third Grapple tests, in May and June 1957, were of staged thermonuclear devices. Whilst they proved the key concepts involved, their yields were below the megaton prediction, and although the second, intervening test had a higher yield, it was a large pure fission device, a generation behind in design. Cook, with British phlegm, admitted to Oulton that "we haven't quite got it right."[5] Returning to the UK, he plunged into planning the methodical steps and calculations necessary to improve understanding of AWRE's staged devices and increase their yield, efficiency and useability. More tests would have to follow, and Oulton, to his surprise, was ordered to reassemble a task force that had thought it was going home. Meanwhile, sensitive to previous complaints about food, AWRE planned its own independent catering facilities in future on Christmas Island.

4. Mid Pacific News, Special Issue Megaton Test, 8 Nov 1957 (copy in AWE archive)

5. Oulton, Christmas Island Cracker, p.356

AWRE high-speed cameras

HM Ships, including the ageing Warrior, about to be sold to Argentina, would be unable to support further tests and this drove the decision to withdraw from Malden Island. Instruments and equipment on board and at Malden had to be reinstalled at the remote south-east corner of Christmas Island itself, where a new radar and airstrip were also built. Tests would now be offshore of this point. A new test – known initially as Windmill and later as Grapple-X, to emphasise continuity with earlier and later tests – was set for November. The Foreign Office feared this would be Britain's last chance, as a UN General Assembly resolution, eventually passed on 14 November, would increase pressure for an immediate test ban. International tension increased in October with the launch of the Soviet Sputnik; on Christmas Island, a film was stopped to allow the audience to watch the little satellite pass in the night sky overhead.

The design of the Grapple-X device was finalised at an extraordinary meeting of Cook's Weapon Development Policy Committee in September. Components were flown out to Christmas Island via Newfoundland, Nebraska, San Francisco and Honolulu between 24-29 October and assembled in the AWRE compound on the main airfield. Weather forced a three-day postponement on 5 November, then all seemed set fair until, at 0100 on the day of the test, an RAF Shackleton patrol aircraft found the Liberian-registered steamer Effie, not only heading towards the island but inside the danger area defined in an Admiralty Notice to Mariners, issued in London too late to reach the ship on her lonely course in the Pacific. Frantic efforts by Shackletons and the guard ship HMS Cossack eventually roused the crew and Effie headed out of the danger area at high speed, just an hour before the test.

AWRE compound at Christmas Island airfield

British nuclear testing at Christmas Island would continue for another year before the US, UK and Soviet Union declared a moratorium on 31 October 1958, and AWRE's thermonuclear warhead design would improve further. But Grapple-X was a significant milestone: the first British test above a megaton yield. Sixty years later, effects data recorded by AWRE scientists in the Pacific are still used to validate computer models in support of today's nuclear mission. The achievements of all three services and the spirit of cooperation on Christmas Island were outstanding. American observers, invited and encouraged to take measurements on neighbouring islands, were impressed too: Doyle Northrup, head of the US Air Force's monitoring effort, offered his "personal congratulations… your shot was heard literally around the world. Every one of our acoustic stations recorded the shot."[6] The Grapple tests reinforced AWRE's credibility in US eyes and strengthened the US-UK atomic relationship when it was restored in 1958.

Testing was controversial, domestically and internationally, as prime minister Macmillan recognised. But he also reflected the views of most British people at the time when he wrote in his diary that tests were "absolutely vital to the safety and strength of Britain."[7]

"Sixty years later, effects data recorded by AWRE scientists in the Pacific are still used to validate computer models in support of today's nuclear mission"

Map of Christmas Island

6. Doyle Northrup to Sir William Penney, 22 November 1957 (AWE archive document)
7. Peter Catterall, ed., The Macmillan diaries Vol.2: Prime Minister and after 1957-66 (Macmillan 2011), entry for 29 May 1958